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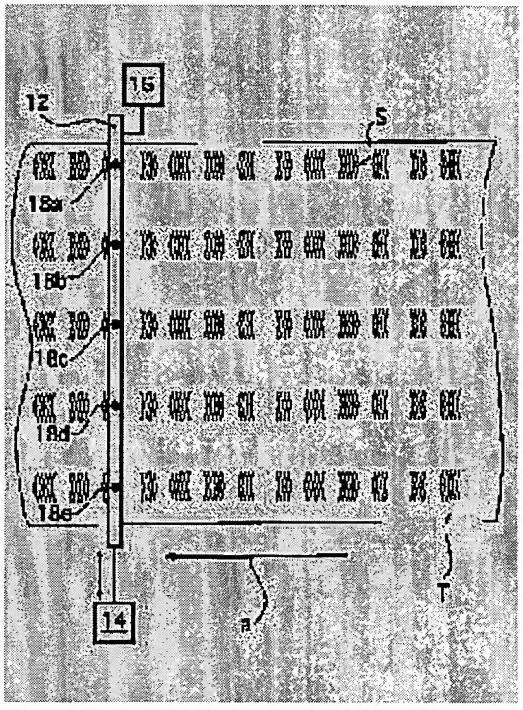
(54) SERVO SIGNAL VERIFYING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a servo signal verifying device capable of verifying all servo signals by feeding a magnetic tape only once, and also suitably detecting small omissions and deficiencies of the servo signals.

SOLUTION: This device is a servo signal verifying device of magnetic tape T having servo signals, and comprises a feeding means for feeding the magnetic tape T in the longitudinal direction, a head part 12 having servo heads with a reading area narrower than a servo signal track width corresponding to each servo signal recorded on the magnetic tape T, a head part moving means 14 for moving the head part 12 back and forth perpendicular to the feeding direction of the magnetic tape T under a prescribed condition, and a judging means for judging whether or not the servo signals recorded on the magnetic tape T are proper, according to the result of the servo signals read by the servo signal reading heads.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention belongs to the technical field of magnetic tapes, such as 3590 and QIC, and relates to the servo signal verification equipment which verifies in detail whether the servo signal recorded in order to perform record and reading of proper information is recorded proper in the magnetic tape which has two or more record bands.
[0002]
[Description of the Prior Art] In recent years, in the information record field using magnetic tapes, such as 3590 and QIC, recording density is very high and there are not few magnetic tapes which have many recording tracks formed crosswise [of a tape]. Therefore, in order to perform record and reading of proper information, it is necessary to a recording track to locate the magnetic head with high precision. While record of the information on a magnetic tape and reading (it only considers as record hereafter) of information convey a magnetic tape to a longitudinal direction (transit), usually it carries out. However, since a magnetic tape is a thin film, it will vibrate delicately crosswise in the case of conveyance, consequently (conveyance Bure) the location of a recording track and the magnetic head will shift relatively. Especially, in recent years, since recording density is high as mentioned above, some location gap also leads to a record mistake.
[0003] Therefore, the servo signal for detecting a recording track is beforehand recorded on the magnetic tape. In the case of informational record, read a servo signal by the magnetic head for servo signal reading (servo head) (detecting), and the magnetic head for record is moved crosswise [of a tape] according to the result. It makes it possible to adjust the location of the magnetic head according to conveyance Bure of a magnetic tape, to locate the magnetic head correctly to a recording track, and to record proper information.
[0004] A servo signal faces across a recording track as an example the short signal which has a predetermined include angle (azimuth) crosswise [of a tape], and comes to record it succeeding the die-length (conveyance) direction of a tape (refer to drawing 1). If a signal (KAKE of a signal) shorter than predetermined die length and the signal (NUKE of a signal) with which the middle has run out are in such a servo signal or there is un-arranging -- there is no signal which should be recorded (signal omission) -- it will become the detection mistake of a servo signal and it will become impossible to record proper information. Although a servo signal is usually recorded in the manufacture process of a magnetic tape, the magnetic tape with the defect of a servo signal is unsuitable nature as a product. Therefore, in manufacture of a magnetic tape, it is necessary to verify whether the servo signal is recorded proper (check).
[0005] The method of reading a servo signal by the servo head same as the verification approach of a servo signal as an actual recording apparatus (or reader) is illustrated. The magnetic head of the usual recording apparatus corresponds only to one record band, and, as for the servo head, one or the two magnetic heads are arranged up and down on the magnetic head of the magnetic tape cross direction, or in the bottom. however, since a large number usually come out and those with two or more and a servo

signal (servo track) also have it according to it, by this approach, a recording track needs to read the servo signal covering the overall length of a magnetic tape two or more times, and requires time amount for verification. Moreover, since the servo head of a recording apparatus corresponds to a field narrower than the whole region of a servo signal, even if there are the above KAKE and NUKE of a signal, it may judge with the proper signal being recorded.
[0006] In order to cancel such un-arranging, the verification equipment of the servo signal of a magnetic tape which has the magnitude in which it has the servo head corresponding to all the servo tracks recorded on a magnetic tape, and this servo head can read the whole region of a servo signal is also known. According to this equipment, all servo signals can be inspected only by conveying a magnetic tape once, but it is difficult to detect NUKE and KAKE of a fine servo signal too also with this equipment, and may judge that an un-fitness servo signal is proper.
[0007]
[Problem(s) to be Solved by the Invention] Various kinds of information which the purpose of this invention has in solving the trouble of said conventional technique, and is used for the 3590th grade to the magnetic tape by which magnetic recording is carried out It is servo signal verification equipment which verifies whether the servo signal is recorded proper. It is in being able to verify all servo signals only by conveying a magnetic tape once, and also detecting NUKE and KAKE of a fine servo signal suitably as well as the signal omission of a servo signal, and offering the servo signal verification equipment which can perform good verification.
[0008]
[Means for Solving the Problem] A conveyance means for this invention to be servo signal verification equipment of the magnetic tape with which the servo signal corresponding to two or more recording tracks is formed, and to convey said magnetic tape to a longitudinal direction in order to attain said purpose, With the head section which has a head for servo signal reading with a reading field narrower than each width of recording track of two or more of said servo signals corresponding to each servo signal recorded on said magnetic tape, and the width of recording track twice [1.1 times to] the width of face of said servo signal A head section migration means to reciprocate said head section in the conveyance direction of said magnetic tape, and the direction which intersects perpendicularly, According to the reading result of the servo signal by said head for servo signal reading, the servo signal verification equipment characterized by whether the servo signal recorded on said magnetic tape is proper and having a judgment means to judge whether it is unsuitable forward is offered.
[0009] When the assembly of a signal in said servo signal which has a frame and the same azimuth for the repeat unit of a servo signal is considered as a burst, moreover, said judgment means Signal sigmati which forms a burst into mono-multi, totals one frame, and is obtained When the following type (1) is filled, And signal Ttrack acquired by monochrome-multi-izing all bursts of one servo signal truck When applied to at least one side in the case of filling the following type (2), it is desirable to judge with the servo signal formed in said magnetic tape being unsuitable nature.
sigmati -- < -- sigma [({(ni-2) xlstripe} /v) +T] .... formula (1)
Ttrack -- < -- TW/vhead .... formula (2)
(In the above-mentioned formula (1) and a formula (2)) ti The i-th burst in a frame The signal formed into mono-multi : ni The number of the servo signals of the i-th burst in a frame: lstripe is about spacing [m] of the servo signal within a burst. : v is about [(vtape) 2+(vhead) 2] 1/2. : T the pulse width of mono-multi : TW Width of recording track of a servo signal [m]: vhead is about the passing speed [m/second] of said head section. : vtape is about the bearer rate [m/second] of a tape. : It is shown, respectively. Moreover, in the summation symbol sigma of the above-mentioned formula (1), addition is performed to the number N of bursts in i= one to one frame.
[0010]
[Embodiment of the Invention] Hereafter, the servo signal verification equipment of this invention is explained to a detail based on the suitable example shown in an attached drawing.
[0011] The conceptual diagram of an example of the servo signal verification equipment of this invention is shown in drawing 1 . The servo signal verification equipment 10 (it considers as verification

equipment 10 hereafter) shown in drawing 1 is equipment which verifies the servo signal recorded on magnetic tape T (it considers as Tape T hereafter) (check), and has fundamentally the head section 12, the migration means 14 of the head section 12, a judgment means 16, and a conveyance means (illustration abbreviation) of a tape T convey Tape T to a longitudinal direction (the direction of drawing 1 arrow-head a).

[0012] In the example of illustration, Tape T has four recording tracks, according to this, faces across each recording track and has the truck (it considers as a servo track S hereafter) of five servo signals in total. Moreover, as one unit, each servo track S repeats this unit, and four sets, five servo signals which have the azimuth of the configuration opened in the direction of drawing Nakamigi, five servo signals which have the azimuth of the configuration opened leftward [this], four servo signals which have the azimuth of the configuration opened rightward [this], and four servo signals which have the azimuth of the configuration opened leftward [this], are formed. Here, let a burst and the repeat unit of a servo signal be frames for the assembly of the same azimuth signal in this invention. That is, one frame consists of four bursts of two bursts which have said five servo signals, and two bursts which have four servo signals, and the servo track S of the example of illustration is formed by the repeat of this frame.

[0013] In addition, in the example of illustration, the servo signal within a burst is formed at intervals of predetermined [fixed], and between bursts is fixed predetermined spacing.

[0014] The head section 12 arranges and has the magnetic head (it considers as the servo head hereafter) which reads a servo signal corresponding to each servo track S of Tape T in the conveyance direction of Tape T, and the direction (it considers as the cross direction hereafter) which intersects perpendicularly, and has the five servo heads 18 (18a, 18b, 18c, 18d, and 18e) in the example of illustration corresponding to five servo tracks S of Tape T. Therefore, all the servo tracks S can be verified only by carrying out conveyance (one pass) of the tape T once from a tip to termination.

[0015] the read head of the well-known magnetic information for which the servo head 18 is used for the recording apparatus (reader) of magnetic information as the servo head in the verification equipment 10 of this invention -- various kinds -- although it is available, in this invention, the reading field of the cross direction of the servo head 18 is narrower than the width of face of a servo track S. In addition, although the reading field of the cross direction of the servo head 18 should be just narrower than the width of face of a servo track S, it is desirable preferably that it takes [1 /] especially for about 1 of the width of face of a servo track S / 100 to 1/10 200 to about 1/5. [of the width of face of a servo track S] It is desirable in respect of the ability to simulate NUKE of the servo signal in the actual drive which can detect KAKE and NUKE of a detailed servo signal more suitably by this.

[0016] In addition, in the verification equipment of this invention, although the number of the servo heads 18 is the same as the number of servo tracks, limitation is not carried out but should just have preferably each servo track formed in Tape T, and the servo head corresponding to all servo tracks. Therefore, as long as record spacing of a servo track etc. corresponds, the tape T which has five servo tracks like the example of illustration may be verified with the verification equipment which may verify the tape T which has three servo tracks with the verification equipment 10 of the example of illustration, for example, or has the ten servo heads.

[0017] In the verification equipment 10 of this invention, conveying Tape T to a longitudinal direction, the head section 12 (namely, servo head 18) is reciprocated crosswise with the migration means 14, by the servo head 18, the servo signal of each servo track S is read, and a servo signal is verified. In this invention, reciprocating the head section 12 crosswise, as mentioned above, using the servo head 18 smaller than the width of face of a servo track S, KAKE of a servo signal which the whole region can be read mostly and is a servo signal not only the signal omission of a servo signal but detailed by this, and NUKE can also be detected suitably, and can perform highly precise verification by what is verified by reading a servo signal.

[0018] There is especially no limitation in the conveyance means of Tape T, and it is good for it by the well-known approach using a capstan roller, a pinch roller, a guide idler, etc. used by a well-known tape manufacturing installation, magnetic recording, etc. the approach using vibration by magnetostriction ingredients using vibration by electrostriction ingredient [like a piezo-electric element available] whose

means of various kinds of by which the migration conditions mentioned later can be carried out as a migration means 14 of the head section 12 on the other hand are, such as an approach and a ferrite, the approach using a voice coil motor, and electromagnetism -- the approach using a tuning fork etc. is illustrated.

[0019] Here, in this invention, width of face of reciprocation of the head section 12 is performed by 1.1 times to the twice of the width of face of the servo band S, and 1.4 times to its 1.6 times are especially desirable.

[0020] Moreover, preferably, reciprocation of the head section 12 is performed so that the following type (3) may be filled.

2 L/vtape < -- TW/vhead < -- 1000 L/vtape .... formula (3)

In addition, L: Die length of one frame [m]

TW : Width of face of a servo track S [m]

vtape: Bearer rate of Tape T [m/second]

vhead: Passing speed [m/second] of the head section 12 it is .

[0021] It is desirable by fulfilling the above-mentioned conditions and performing reciprocation of the head section 12 in respect of KAKE and NUKE of a servo signal of the tape overall length which can detect KAKE and NUKE of a detailed servo signal more suitably, and all servo-track fields being suitably detectable etc.

[0022] The output of each servo head 18 of the head section 12 is sent to the judgment means 16. The judgment means 16 is a part which judges whether the output signal of each servo head 18 is processed, and the servo signal is recorded on Tape T proper. The block diagram of an example of the judgment means 16 is shown in drawing 2 . In addition, although only judgment means 16a corresponding to servo-head 18a is shown in drawing 2 , the verification equipment 10 of the example of illustration has the five servo heads 18, and the judgment means 16 also has a judgment means corresponding to each of the servo heads 18b, 18c, 18d, and 18e besides judgment means 16a.

[0023] judgment means 16a -- fundamental -- the [the waveform-shaping section 20 and] -- the [the 1 retriggerable mono-multi processing section 22 (the / the following and / -- it considers as 1 mono-multi processing section 22), a count area 24, the 1st total section 26, an impulse counter 28, the 1st judgment section 30, and] -- it has 2 mono-multi processing section 32, the 2nd total section 34, and the 2nd judgment section 36, and is constituted. the example of illustration -- setting -- the -- the block from the lower stream of a river of 1 mono-multi processing section 22 to the 1st judgment section 30 -- it is -- verification of each frame of a servo track S -- carrying out -- the -- from the lower stream of a river of 1 mono-multi processing section 22, it is the block which results in the 2nd judgment section 36, and verification to the whole one servo-track S is performed.

[0024] Hereafter, with reference to the timing chart shown in drawing 3 , the judgment means 16 is explained more to a detail. In addition, by this example, in order to give explanation simple, although [drawing 3] spacing of a burst of an input signal is fixed, since it reciprocates crosswise and the head section 12 is performed, conveying Tape T for verification of the servo signal which has the azimuth from which a direction differs to a longitudinal direction, spacing of a burst of an actual input signal is changed. Moreover, as for a judgment means, in this invention, it is needless to say that it is not limited to the following configurations and approaches.

[0025] first, the input signal (** of drawing 3) inputted into judgment means 16a is shaped in waveform in the waveform-shaping section 20 by reading of the servo signal by servo-head 18a, and is shown in ** of drawing 3 by it -- as -- HIGH and LOW it considers as a binary signal -- having -- subsequently -- the -- it is sent to 1 mono-multi processing section 22. the -- the signal shaped in waveform is formed into mono-multi in 1 (retriggerable) mono-multi processing section 22. That is, as the signal shaped in waveform detects the field outputted at the predetermined spacing (spacing lstripe of the servo signal under = burst) and is shown in **-a of drawing 3 , from the beginning of the signal outputted at the predetermined spacing to the last is made into one continuous signal. Therefore, if the servo signal is recorded proper, the signal formed into mono-multi will serve as the die length of the burst which is the assembly of the same azimuth signal. In addition, from formation spacing of the bearer rate of Tape T,

or a servo signal etc., the spacing lstripe of a servo signal is computed beforehand, is set as the 1st monochrome multi-processing section 22, and may perform mono-multi-ization using this.
[0026] The signal (it considers as a mono-multi signal hereafter) processed in the 1st monochrome multi-processing section 22 is sent to a count area 24 and the 2nd monochrome multi-processing section 32. According to the reset signal in every frame outputted from a clock signal (CLK) and an impulse counter 28, a mono-multi signal counts the time amount of HIGH, and a count area 24 sends it to the 1st total section 26. In the example of illustration, since one frame consists of four bursts, an impulse counter 28 outputs the pulse signal which turns into a reset signal every four bursts to a count area 24 (and the 1st total section 26), as shown in ** of drawing 3 . According to this reset signal, for every frame, a mono-multi signal counts the time amount of HIGH, and a count area 24 is the time amount t1 of HIGH of each burst, t2, and t3. And t4 It carries out and sends to the 1st total section 26.
[0027] The 1st total section 26 responds to the reset signal outputted from the impulse counter 28, and is the time amount t1 of said HIGH, t2, and t3. And t4 It incorporates and totals and sends to the 1st judgment section 30 as time amount of HIGH in one frame. That is, the 1st total section 26 is signal sigmati which totals one mono-multi signal of a burst and is obtained. It computes and sends to the 1st judgment section 30. i is the sequence of the burst in the frame. Therefore, in the summation symbol sigma of the above-mentioned formula, addition is performed to the number N of bursts in i= one to one frame (the example of illustration 4).
[0028] The 1st judgment section 30 performs a predetermined operation, and is this sigmati. NG signal is outputted noting that the servo signal of that frame is unsuitable nature, when filling the following type (1).
sigmati -- < -- sigma [({(ni-2) xlstripe} /v) +T] .... formula (1)
in addition, ni : several [of the servo signal of the i-th burst in a frame] -- lstripe: Spacing [m] of the signal within a burst
v: [(vtape) 2+(vhead) 2] 1/2T : By the output pulse width of face of the 1st monochrome multi-processing section 22, it is the same as that of said formula (3) except it. Moreover, addition of the summation symbol sigma in a formula (1) is sigmati. It is the same.
[0029] In addition, what is necessary is just to set up the output pulse width of face T of the 1st monochrome multi-processing section 22 in circuit in the range which fills the following type (4).
lstripe/v < -- T < -- (2 and lstripe) /v .... formula (4)
[0030] As mentioned above, the mono-multi signal processed in the 1st monochrome multi-processing section 22 is outputted also to the 2nd monochrome multi-processing section 32. the -- the signal of the purport that servo-head 18a separated from 2 mono-multi processing section 32 from the servo track S -- responding -- the -- the mono-multi signal (refer to **-[of drawing 3] b) outputted from 1 mono-multi processing section 22 is further formed into mono-multi, and as shown in **-b of drawing 3 , it is sent to the 2nd total section 34 as a mono-multi signal corresponding to one servo track S. This mono-multi signal incorporates the time amount of HIGH, and the 2nd total section 34 is Signal Ttrack about this time amount. It carries out and is this Ttrack. It sends to the 2nd judgment section 36.
[0031] The 2nd judgment section 36 performs a predetermined operation, and is this Ttrack. NG signal is outputted noting that the servo signal of that servo track is unsuitable nature, when filling the following type (2).
Ttrack <TW/vhead .... Formula (2)
In addition, TW Width of recording track of a servo signal [m]: Except it, it is the same as that of each above-mentioned formula.
[0032] What is necessary is just to determine the criterion suitably according to the precision and recording density which are required of Tape T in manufacture of the tape T using the verification equipment 10 of the example of illustration, although it judges whether they are whether the tape T is proper as a product, and unsuitable nature according to NG signal outputted from the 1st judgment section 30 and the 2nd judgment section 36. For example, when at least one NG signal comes out, you may judge with the tape T being unsuitable nature. You may judge with it being unsuitable nature when NG signal more than a predetermined number comes out to a frame. You may judge with NG signal

over a frame being unsuitable forward when you may judge with it being unsuitable nature when NG signal over a servo track S comes out, even if it was below a predetermined number, and NG signal appears in coincidence with further two or more servo tracks. Moreover, these may be used combining plurality.

[0033] As mentioned above, although the servo signal verification equipment of this invention was explained to the detail, in the range in which limitation is not carried out to the above-mentioned example, and this invention does not deviate from the summary of this invention, what may make various kinds of amelioration and modification is natural.

[0034]

[Effect of the Invention] As mentioned above, according to the servo signal verification equipment of the magnetic tape of this invention, as explained to the detail, only by conveying a magnetic tape once, all the servo signals recorded on the magnetic tape can be verified, and as well as the signal omission of a servo signal, NUKE and KAKE of a fine servo signal can also be detected suitably, and can verify a suitable servo signal.

[Translation done.]